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I, JONNE YABSLEY, TEAM LEADER EXAMINATION SUPPORT AND SALES hereby certify that annexed is a true copy of the Provisional specification in connection with Application No. PR 2115 for a patent by UGO ENVIRO PTY LTD filed on 15 December 2000.

I further certify that pursuant to the provisions of Section 38(1) of the Patents Act 1990 a complete specification was filed on 14 December 2001 and it is an associated application to Provisional Application No. PR 2115 and has been allocated No. 97254/01.

WITNESS my hand this
Twentieth day of December 2001

A handwritten signature in cursive script, reading "J R Yabsley".

JONNE YABSLEY
TEAM LEADER EXAMINATION
SUPPORT AND SALES

AUSTRALIA

PATENTS ACT 1990

PROVISIONAL SPECIFICATION

FOR THE INVENTION ENTITLED:-

"A METHOD OF TREATING SEWAGE"

The invention is described in the following statement:-

The present invention relates to a method of treating sewage.

The invention has been developed primarily for use with sewage comprised of human waste and will be described hereinafter with reference to that application.

However, we appreciate that the invention is not limited to that particular field of use and
5 is also applicable to the processing of animal and other organic waste.

The disposal of human and animal waste is a large problem facing the world community, particularly in locations where population densities are high. In some cases, it is common practice or at least known to pump untreated or primary treated sewage into natural waterways or, for coastal cities, the adjacent ocean. Clearly this is an undesirable
10 and unsustainable long term solution.

In those locations that utilise secondary and tertiary treatment plants for processing the sewage, there are ongoing issues of cost and efficiency. These plants have to be large in area, are expensive to run, take considerable time to process the sewage, and consume large amounts of energy.

15 It is an object of the present invention, at least in a preferred embodiment, to overcome or substantially ameliorate one or more of the disadvantages of the prior art or at least provide a useful alternative.

According to a first aspect of the invention there is provided a method for treating sewage in a fluid, the method including the steps of:

20 locating the sewage and fluid in a holding tank;

releasing live fish into the holding tank; and

allowing the fish to consume and otherwise process the sewage whereby a layer of sediment is formed in the tank including waste from the fish.

Preferably, the method includes the step of progressively providing the fluid containing sewage to the tank. More preferably, the method includes the step of providing the fluid containing sewage to the tank at a predetermined rate. In some embodiments, the predetermined rate varies with time.

- 5 In a preferred form, the tank includes an overflow path and the method includes the step of continuing to progressively provide the fluid containing the sewage into the tank so that fluid and/or sewage progresses along the overflow path. More preferably, the holding tank is linked to a further tank and the method includes the step of allowing the fluid and/or sewage that progresses along the overflow path to flow into the further tank.
- 10 Even more preferably, the method includes the step of releasing live fish into the further tank.

Preferably, the method includes the further step of removing the fluid from the tank. More preferably, the fluid is removed progressively over time. Even more preferably the fluid is removed by evaporation.

- 15 Alternatively, the fluid is removed once sufficient sewage has been processed by the fish. More preferably, the fluid is removed with any unprocessed sewage.

In a preferred form, the method includes the step of removing the layer of sediment from the tank.

- Preferably, sewage and fluid are located in a plurality of tanks containing respective
- 20 fish, and wherein after a predetermined period of fluid and any remaining sewage are removed from those tanks and placed in other tanks containing additional live fish.

Preferably also, the fluid is water. More preferably, the water is recovered from prior performances of the method described above.

According to a second aspect of the invention there is provided a sewage treatment plant including a plurality of interlinked holding tanks for sequentially receiving sewage or sewage containing additional fluid and for containing live fish to consume and otherwise process the sewage whereby a layer of sediment is formed in the tank including
5 waste from the fish.

According to a third aspect of the invention there is provided a method of producing fish meal from sewage including the steps of:

- introducing fluid into the sewage;
- locating the sewage and the fluid in a holding tank;
- 10 releasing live fish into the tank; and
- allowing the fish to consume and otherwise process the sewage whereby a layer of fish meal is formed in a tank comprising waste from the fish and/or the fish themselves.

According to a fourth aspect of the invention there is provided a method for treating water containing sewage, the method including the steps of:

- 15 locating the water and sewage in a holding tank;
- releasing live fish into the holding tank;
- allowing the fish to consume and otherwise process the sewage whereby a layer of sediment is formed in the tank including waste from the fish
- removing the water from the tank.

20 According to a sixth aspect of the invention there is provided a method for producing fish meal, the method including the steps of:

- locating sewage and a fluid in a holding tank;
- releasing live fish into the holding tank;

allowing the fish to consume and otherwise process the sewage whereby a layer of sediment is formed in the tank including waste from the fish; and

removing the fish from the tank and processing these to produce the fish meal.

According to a seventh aspect of the invention there is provided a method for
5 producing fish meal, the method including the steps of:

locating sewage and a fluid in a holding tank;

releasing live fish into the holding tank;

allowing the fish to consume and otherwise process the sewage whereby a layer of sediment is formed in the tank including waste from the fish and the fish themselves;

10 removing the layer from the tank and processing this to produce the fish meal.

Preferably, the processing includes adding grains to the fish meal. More preferably, the grains are wheat or barley.

Preferred embodiments of the invention will now be described, by way of example only, with reference to the accompanying drawings in which:

15 Figure 1 is a top view of two holding tanks for use with the invention; and

Figure 2 is a cross section through one of the tanks of Figure 1.

Referring to the drawings, a first holding tank 1 includes a base 2 and a plurality of sidewalls 3 extending upwardly from the base to define an open top 4. An inlet pipe 5 provides raw sewage 6 into tank 1. That is, tank 1 is part of a sewage treatment plant
20 comprised of six like interlinked tanks.

Tank 1 has an average depth of about 1½ metres and a surface area of about 60 hectares.

As will be appreciated by those skilled in the art, the sewage contains a certain amount of fluid, in the form of liquid waste, as well as water to ensure the more solid matter travels through the sewerage pipes to the treatment plant. In some embodiments the amount of water contained within the sewerage is sufficient, while in other
5 embodiments more water is added to dilute the sewage for optimum processing. This additional water is often required to reduce the concentration of certain elements such as nitrogen.

After a predetermined volume of sewage and other fluids are contained within tank 1 the inflow is halted and a number of live fish are introduced into tank 1. In this embodiment
10 use is made of European carp or the like which are sufficiently robust to not only survive in the sewage and water mix, but are able to consume sewage and derive sufficient nutrients from this. That is, the fish allow the conversion of the sewage into fish manure that progressively builds up on the bottom of the tank. Moreover, the movement of the fish in tank 1 assists the processing of the sewage by aeration.

15 European carp are also well adapted for use with the invention as they can absorb oxygen from the air in the event that the oxygen content of the water is too low. However, it is proposed that the concentration of the carp should be high and the tank shallow so that the movement of the fish will cause agitation and oxygenation of the water.

20 With time, a layer of sediment 8 accumulates on base 2 comprised of the processed sewage and/or the fish themselves. Once sufficient material has accumulated in layer 8 the remaining water, designated by reference numeral 9 in Figure 2, is pumped or gravity

fed to an adjacent like holding tank 10. Alternatively, water 9 is allowed to slowly evaporate and the fish allowed to incorporate into layer 8.

Once the water is removed the layer 8 can be recovered from base 2 and processed into other products such as fish meal and on sold as a stock feed supplement or the like. It
5 will be appreciated that as layer 8 will be comprised of fish manure and/or the fish themselves that far fewer subsequent processing problems arise than would be the case with the original sewage that is provided into tank 1.

In some embodiments layer 8 is recovered prior to removal of water 9. Moreover, in other embodiments water 9 is further processed in tank 10 by additional fish. In either
10 case, once the fish, or the layer that incorporating the fish, is removed, it is subsequently processed to produce fish meal. This fish meal is a mix of the fish themselves together with other coarse grains.

It will be appreciated that the concentration of fish within tank 1 is high and preferably in the order of 50 fish per cubic metre of sewage. It would be appreciated by
15 those skilled in the art that alternative concentrations can be used.

In larger applications use is made of a plurality of holding tanks in parallel.

In other embodiments, the fish are periodically harvested. In the case of European carp, the harvesting is for the purposes of producing fish meal from the carp.

That is, the invention allows the processing of sewage to result in a high protein fish
20 meal that can be used to feed other fish or marine life- such as those farmed for human consumption.

In some embodiments the invention is used as a second stage treatment of sewage, with the prior first stage treatment removing about half of the solid matter within the sewage

as well as reducing the concentration of nitrogen and other elements to level that will allow the habitation of fish within the sewage. Generally, raw sewage contains about 20% solids.

In a further embodiment of the invention, the water and sewage is progressively feed through a sequence of the tanks each of which contain high concentration of European carp.

5 The water that is release from the last of the tanks being suitable for release back into the environment. In some embodiments, however, the water requires further processing. This is dependent upon the nature of the sewage and the effectiveness of the fish in processing that sewage.

The progressive flow of the water and sewage is maintained for a long period,
10 presently envisaged as being in the order of two to four years. In this period the fish are harvested and replaced, as required. At the end of the period the fish are removed from the tanks and the remaining liquid being removed or allowed to dry so that the sediment remaining at the bottom of the tanks can be easily removed. This sediment is then used as a fertiliser or supplement for soil.

15 The progressive flow of water and sewage is then recommenced into the tank and additional fish released into the tank to recommence the process.

That is, the preferred embodiments of the invention offer two distinct alternatives to creating the fish meal, these being:

1. Having a continuing flow of sewage through the tank and periodically harvesting the fish
20 for processing into fish meal; or
2. Having the flow of sewage segmented and allowing the fish to incorporate into the layer on the bottom of the tank, and subsequently retrieving and processing that layer to provide the fish meal.

Although the invention has been described with reference to a specific example it will be appreciated by those skilled in the art that it may be embodied in many other forms.

DATED this 15th Day of December 2000

5 UGO ENVIRO PTY LTD

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